PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : F01N 3/28

A1

(11) International Publication Number: WO 96/34188

(43) International Publication Date: 31 October 1996 (31.10.96)

(21) International Application Number: PCT/SE96/00499

(22) International Filing Date: 18 April 1996 (18.04.96)

(30) Priority Data:
9501556-6 27 April 1995 (27.04.95) SE

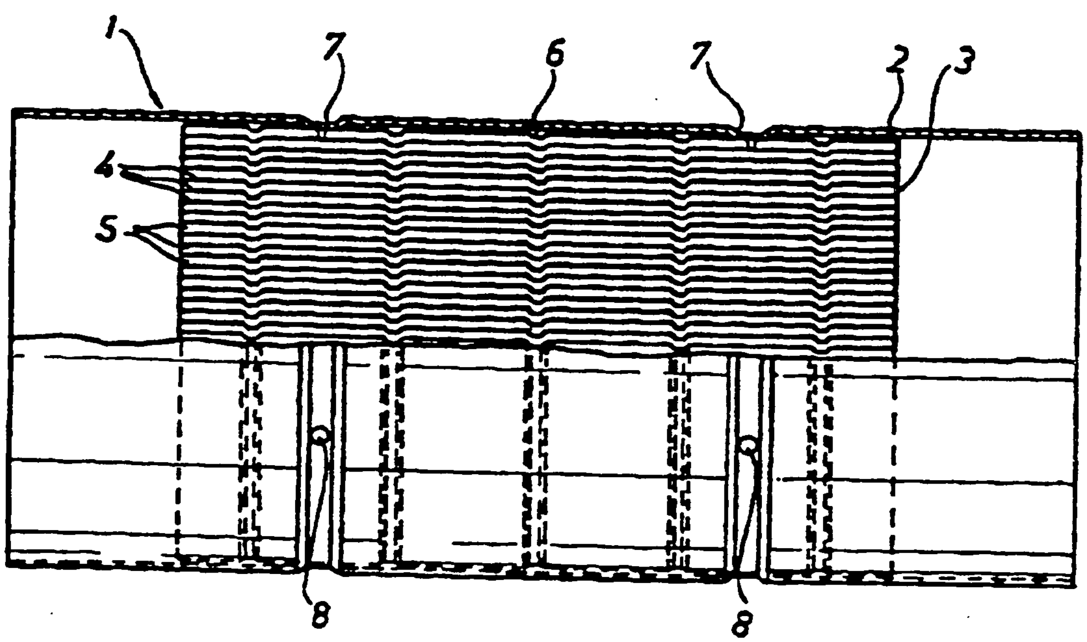
(71)(72) Applicant and Inventor: NILSSON, Sven, Melker [SE/SE]; P.O. Box 56, S-430 50 Kållered (SE).

(74) Agent: AWAPATENT AB; P.O. Box 11394, S-404 28 Göteborg (SE).

(81) Designated States: AL, AM, AT, AT (Utility model), AU, AZ, BB, BG, BR, BY, CA, CH, CN, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, ES, FI, FI (Utility model), GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.
In English translation (filed in Swedish).

(54) Title: A CATALYST CARRIER ARRANGEMENT



(57) Abstract

The invention concerns a carrier arrangement for catalytic converters comprising a catalyst body (1) consisting of a monolith (3) formed of carrier members desined to support a catalytic material, and of a metal casing (2, 9) enclosing the monolith (3). The interior width of the casing (2, 9) exceeds that of the monlith (3) whereby a gap (6, 11) forms between the casing (2, 9) and the monolith (3). This gap (6, 11) is bridged at least in the area of a section (7, 10) extending circumferentially around the monolith (3), the monolith (3) being attached to the casing (2, 9) along said section (7, 10).

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AM	Armenia	GB	United Kingdom	MW	Malawi
AT	Austria	GE	Georgia	MX	Mexico
AU	Australia	GN	Guinea	NE	Niger
BB	Barbados	GR	Greece	NL	Netherlands
BE	Belgium	HU	Hungary	NO	Norway
BF	Burkina Faso	IE	Ireland	NZ	New Zealand
BG	Bulgaria	IT	Italy	PL	Poland
BJ	Benin	JP	Japan	PT	Portugal
BR	Brazil	KE	Kenya	RO	Romania
BY	Belarus	KG	Kyrgystan	RU	Russian Federation
CA	Canada	KP	Democratic People's Republic of Korea	SD	Sudan
CF	Central African Republic			SE	Sweden
CG	Congo	KR	Republic of Korea	SG	Singapore
CH	Switzerland	KZ	Kazakhstan	SI	Slovenia
CI	Côte d'Ivoire	LI	Liechtenstein	SK	Slovakia
CM	Cameroon	LK	Sri Lanka	SN	Senegal
CN	China	LR	Liberia	SZ	Swaziland
CS	Czechoslovakia	LT	Lithuania	TD	Chad
CZ	Czech Republic	LU	Luxembourg	TG	Togo
DE	Germany	LV	Latvia	TJ	Tajikistan
DK	Denmark	MC	Monaco	TT	Trinidad and Tobago
EE	Estonia	MD	Republic of Moldova	UA	Ukraine
ES	Spain	MG	Madagascar	UG	Uganda
FI	Finland	ML	Mali	US	United States of America
FR	France	MN	Mongolia	UZ	Uzbekistan
GA	Gabon	MR	Mauritania	VN	Viet Nam

A CATALYST CARRIER ARRANGEMENT

The subject invention concerns a carrier arrangement for catalytic converters.

As substrates to be used to support the catalytic material in internal combustion engine exhaust systems ceramic materials are predominantly used. In latter years, metal substrates have, however, come into use to an increasingly large extent. The advantage of metal substrates is their ability to reach working temperatures more rapidly than do cermamic ones, as accordingly they begin their exhaust gases purification function at an earlier stage after start, which is a most essential feature. Moreover, metal substrates are more efficient thermal conductors, and thus they may be heated more quickly and the risk of local overheating is reduced. In addition, metal substrates support higher temperatures than ceramic ones.

As carrier members supporting the catalytic material so called metal monoliths are used. These consist of metal foils, preferably of stainless steel, wound into rolls wherein metal foils of flat configuration alternate with metal foils of corrugated configuration, whereby throughflow channels extending through the catalyst body are formed. The foil thickness is small, normally only about 0.05 mm. The catalyst body also includes a metal cover forming a jacket surrounding the monolith in contact with the latter. The cover thickness may amount to approximately 1 - 1.6 mm.

When the hot exhaust gases flow through the monolith during the combustion engine operation the thin carrier member foils are heated very rapidly. Usually, the temperature quickly reaches between 500 and 800°C. In some types of engines, the temperature may rise to the range of up to between 1100 and 1200°C. As soon as the

engine stops, the temperature of the catalyst body rapidly sinks to the level of the ambient temperature.

The repeated temperature changes constitue a problem that affects the catalyst long-term durability. The rapidly heated thin foils of the monolith also expand quickly. The surrounding casing, in abutment against the monolith but not in close contact with the exhausts and in addition having a larger material thickness, is heated and expands at a slower pace. During the heating, the casing thus prevents the monolith from expanding, which gives rise to considerable radial compressive forces that cause deformations to form in the monolith. When the abovementioned high temperature levels are reached, the strength of the metal also is reduced considerably, often down to about 10% of its strength at room temperature, which aggravates the deformations and reduces the monolith life further.

When the engine is stopped and the exhausts cool down the opposite phenomenon occurs, i.e. the monolith foils cool at a higher speed than the surrounding thicker casing. As a result, considerable tensile forces generate between the outermost part of the monolith and the cover.

For the reasons outlined in the aforegoing, considerable problems are involved as regards the attachment of metal monoliths in their casings. Several various solutions have been proposed and tested, but often with poor results. Some viable constructions have been developed, e.g. by the German company Emitec GmbH, but they are comparatively complex and expensive. A feature common to all these prior-art solutions is that they apply to monoliths wherein the various metal foil layers are interconnected by means of soldering, with the outermost layer being soldered to the surrounding jacket.

The subject invention provides a simple, reliable and economical solution to the securement problem. The solution functions both when applied to metal monoliths soldered together in the manner indicated above and when

applied to metal monoliths joined together in some other manner, without soldering. The characteristic features of the attachment arrangement appear from the appended claims.

The invention will be described in closer detail in the following with reference to the accompanying drawings, wherein

Fig. 1 is a broken schematical longitudinal sectional view through a catalyst body,

Fig. 2 is a similar schematical longitudinal sectional view through a catalyst body showing a modified arrangement of attachment in accordance with the invention, and

Fig. 3 is a larger-scale view of a part of the attachment arrangement in accordance with the invention.

Fig. 1 illustrates a basic design of the inventive object. A catalyst body 1 comprises a metal casing 2 enclosing a so called monolith 3. The latter in turn consists of carrier members, designed to support a catalytic material and consisting of helically wound metal foils; arranged so that flat metal foils 4 alternate with corrugated metal foils, so as to form through-flow channels 5 extending through the catalyst body 1. The monolith 3 has a width or diameter that is slightly smaller than the internal width of the casing 2. Accordingly, a gap 6 forms between the casing 2 and the monolith 3, the size of which varies within different temperature ranges.

In accordance with the invention, the casing 2 is provided with at least one band-like depression 7, in accordance with the embodiment illustrated in the drawing figure with two such depressions, the gap 6 around the monolith 3 thus being eliminated in the area opposite said depressions. Along these depressions 7 the casing 2 and the monolith 3 are interconnected, preferably only at spaced intervals 8, for instance by means of soldering or welding.

When the monolith 3 is heated by the exhaust gases flowing through it, the monolith 3 expands quicker than the casing 2, which is due partly to the more intimate contact of the monolith 3 with the hot exhaust gases, partly to the larger material thickness of the casing 2. The expansion may now take place essentially unimpededly, with the exception of in the area of the depressions 7 where a certain deformation of the outermost foil 4 of the monolith 3 will take place. Consequently, no compressive forces will generate along the major part of the surface of the monolith 3. When the casing and the monolith 3 again cool down, the monolith 3 may again retract and thus again open up a gap 6.

Because the monolith 3 is exposed only to minor local deformations in the area of the depressions 7 and is allowed to expand and contract freely elsewhere, the catalyst body 1 may operate in an intact condition over a longer period than has hitherto been possible, with consequential increase of its serviceable life.

Further improvements may be achieved by omitting to join one or some of the outermost foils 4 along the entire foil length to the the foils immediately interiorly thereof but instead joining them to one another at points spaced laterally from the points 8 of attachment. When the monolith 3 cools down, with consequential contraction, the tensile forces at the points 8 of attachment will not be very pronounced because of the resiliency imparted to the outermost foils 4 between their interconnection points.

Figs. 2 and 3 illustrate a modification of the mode of attachment in accordance with the invention. In this case, an exhaust pipe 9 serves as the casing. In accordance with this modification, the monolith 3 is provided at each end with a circumferential collar 10 which projects past its associated monolith end and which is attached to the exhaust pipe 9. In the same manner as in accordance with the embodiment of Fig. 1, the collars

10 preferably are attached to the monolith 3 at discrete intervals 12. The collars 10 bridge a gap 11 formed between the exhaust pipe 9 and the monolith 3, the latter thus, upon heating and cooling, being given a comparatively free space in which to expand and contract while at the same time it is securely anchored inside the exhaust pipe 9.

The invention is not limited to the embodiments as shown and described but could be modified in a variety of ways within the scope of the appended claims. For instance, the gap 6 could be eliminated by introduction of one or several inserts between the casing 2 and the monolith 3 instead of by forming depressions 7 in the casing.

CLAIMS

1. A carrier arrangement for catalytic converters of the kind comprising a catalyst body (1) which consists of a monolith (3) of carrier members designed to support a catalytic material, said carrier members formed by superposed, alternately flat and corrugated metal foils (4) which are helically wound to form through-flow channels (5) extending through the catalyst body (1), and of a metal casing (2, 9), the material thickness of which exceeds that of the metal foils (4) and which casing encloses the monolith (3), c h a r a c t e r i z e d in that the interior width of the casing (2, 9) exceeds that of the monolith (3), whereby a gap (6, 11) forms between the casing (2, 9) and the monolith (3), and in that said gap (6, 11) is bridged at least in the area of a section (7, 10) extending circumferentially around the monolith (3), said monolith (3) being attached to the casing (2, 9) along said section (7, 10).

2. An arrangement as claimed in claim 1, c h a r a c t e r i z e d in that the gap (6) is bridged in the area of said section (7) by a radial depression of the casing (2).

3. An arrangement as claimed in claim 1, c h a r a c t e r i z e d in that in the area of said section (7) the monolith (3) is attached to the casing (2) only in some points (8) circumferentially around the monolith.

4. An arrangement as claimed in claim 1, c h a r a c t e r i z e d in that the monolith (3) is formed at each end with a circumferential collar (10) which bridges the gap (11) between the monolith (3) and the casing (9) and which is attached to said casing (9).

5. An arrangement as claimed in claim 4, c h a r a c t e r i z e d in that the collar (10) is attached to the monolith (3) only at some points (12) along the monolith circumference.

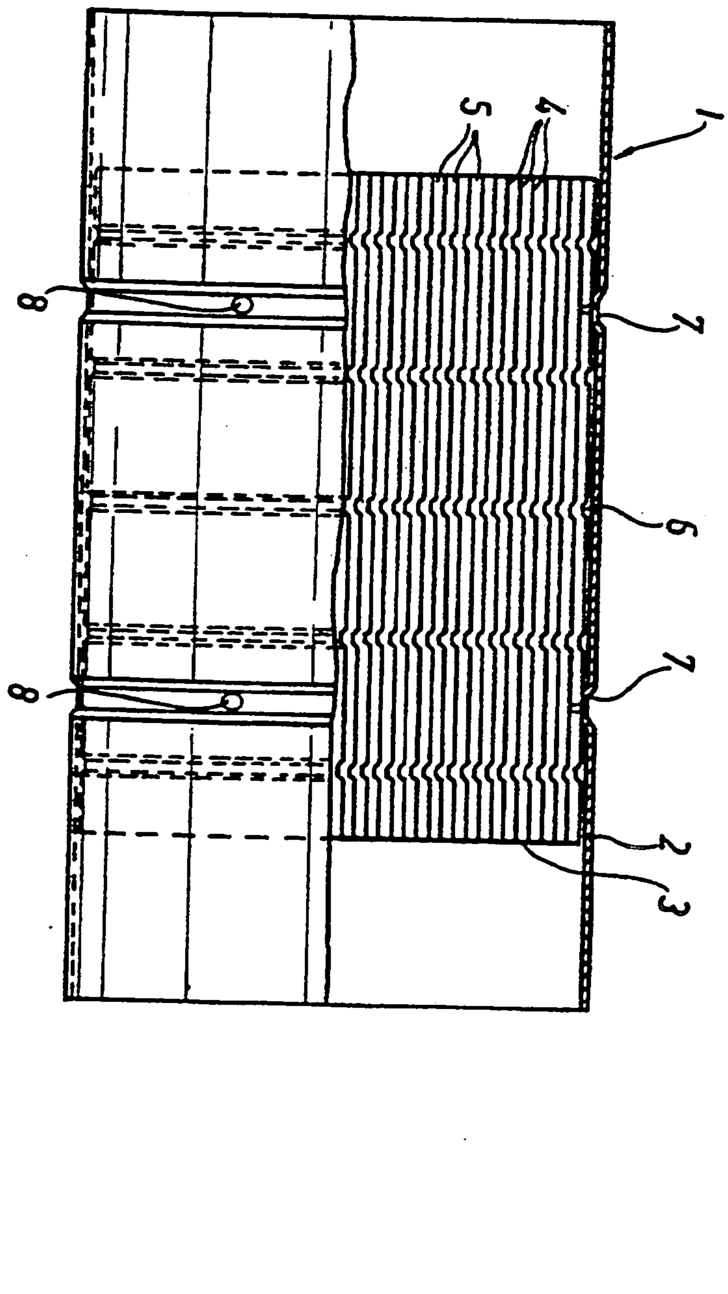


Fig.1

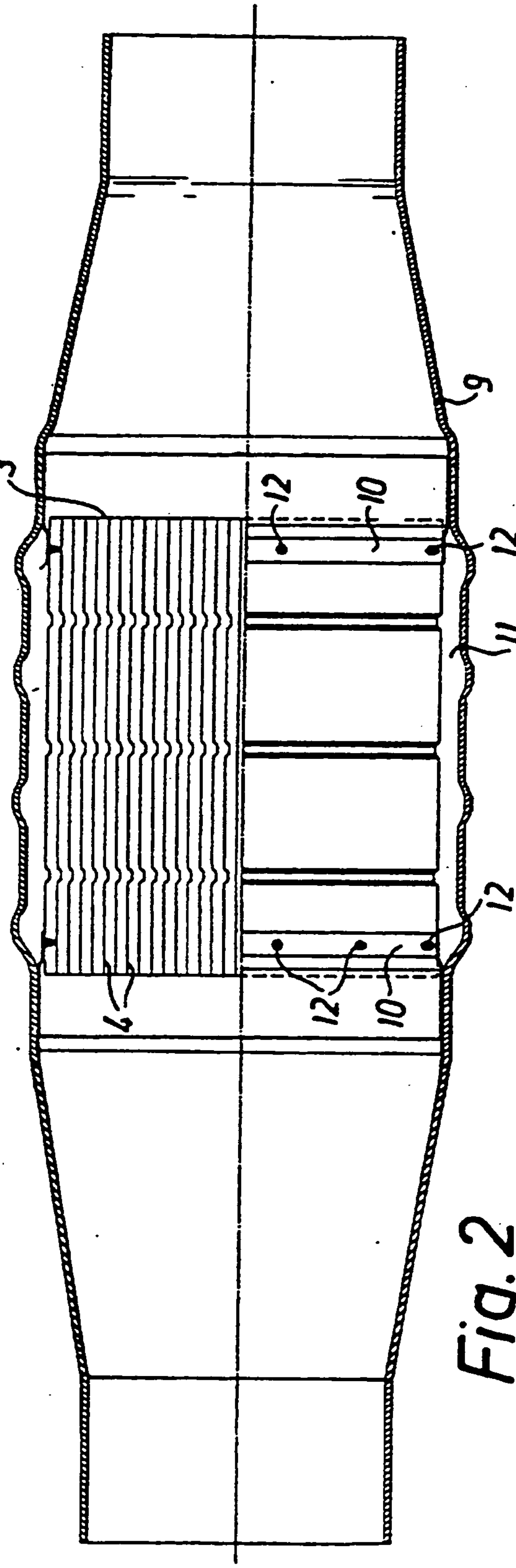
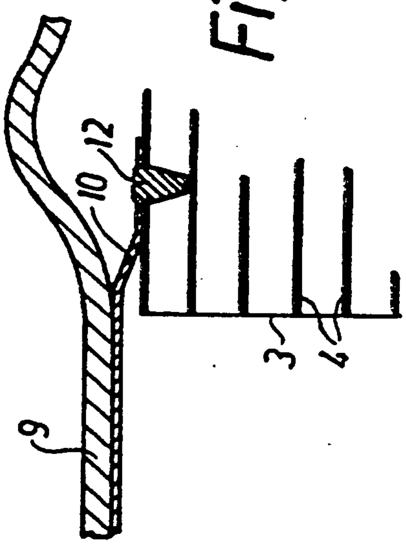


Fig. 2

Fig. 3



INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 96/00499

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: F01N 3/28

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: F01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0212243 A1 (INTERATOM GESELLSCHAFT MIT BESCHRÄNKTER HAFTUNG), 4 March 1987 (04.03.87), figure 1, abstract --	1,3
A	WO 9004087 A1 (EMITEC GESELLSCHAFT FÜR EMISSIONSTECHNOLOGIE MBH), 19 April 1990 (19.04.90), abstract -- --------	1-5

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" erlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing f the international search report
25 July 1996	31 -07- 1996
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Jan Carlerud Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

01/07/96

International application No.
PCT/SE 96/00499

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A1- 0212243	04/03/87	SE-T3- 0212243	
		JP-C- 1572383	25/07/90
		JP-A- 62030533	09/02/87
		KR-B- 9501772	02/03/95
		US-A- 4795615	03/01/89
		US-A- 5116581	26/05/92
WO-A1- 9004087	19/04/90	DE-U,U- 8812762	29/06/89
		DE-D- 58908018	00/00/00
		EP-A,A,B 0435956	10/07/91
		SE-T3- 0435956	
		JP-T- 4501753	26/03/92
		RU-C- 2015356	30/06/94
		US-A- 5173267	22/12/92
		US-A- 5190732	02/03/93